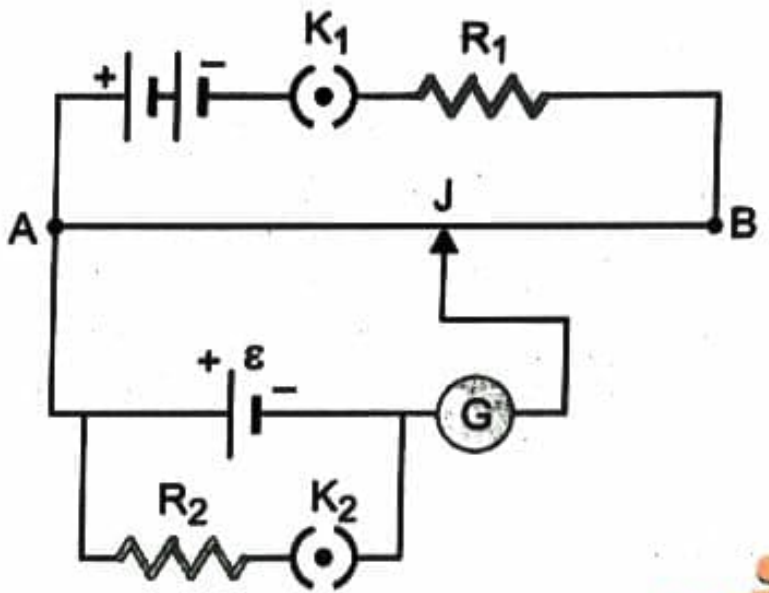
Home Assignment

Question: For the circuit shown in the below figure would the balancing length increase, decrease or remain the same if

a) R_1, is decreased

b) R_2 is increased,

without any change (in each case) in the rest of the circuit ? Justify your answer in each case.



ODM PUBLIC SCHOOL

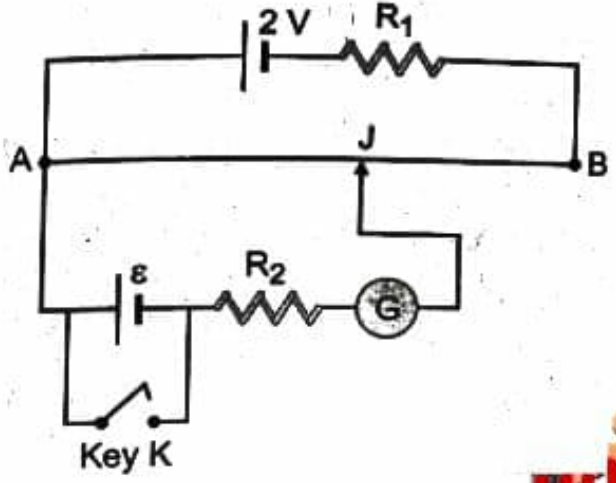
Home Assignment

Question: Answer the following.

a) State the underlying principle of a potentiometer. Why is it necessary to
   i. use a long wire,
   ii. have uniform area of cross-section of the wire and
   iii. use a driving cell whose emf is taken to be greater than the emfs of the primary cells?

b) In a potentiometer experiment, if the area of the cross-section of the wire increases uniformly from one end to the other, draw a graph showing how potential gradient would vary as the length of the wire increases from one end.

Question: Below figure shows the circuit diagram of a potentiometer for determining the emf ε of a cell of negligible internal resistance.



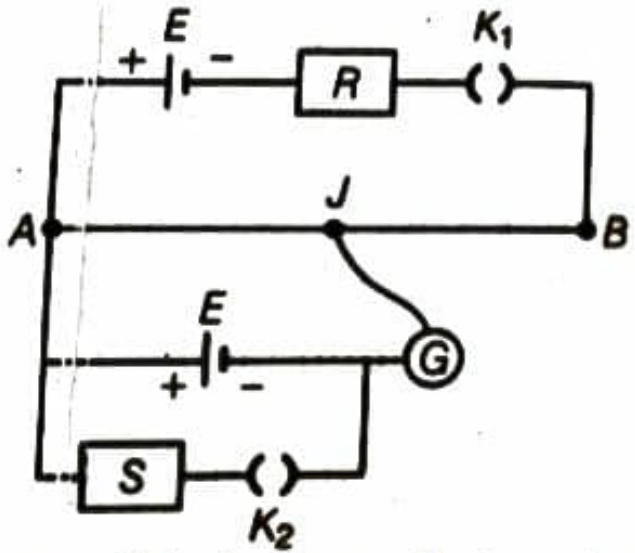
a) What is the purpose of using high resistance R_2?

b) How does the position of balance point (J) change when the resistance R_1, is increased?

c) Why cannot the point be obtained,
   1) When the emf ε is greater than 2V, and
   2) When the key K is closed.

Home Assignment

Question: Two students X and Y perform an experiment on potentiometer separately using the circuit given below. Keeping other parameters unchanged, how will the position of the null point be affected, if



a) X increases the value of resistance R in the setup by keeping the key K_1 closed and the key K_2 open?

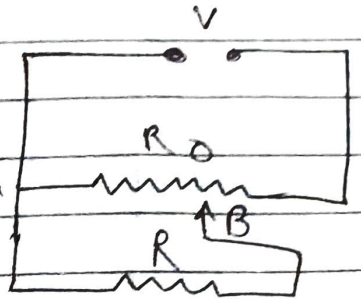
b) Y decreases the value of resistance S in the setup, while the key K_2 remains open and then K_1 closed?

Justify your answer.

4/6/21

HOME ASSIGNMENT.

1) $R_{total} = \dfrac{\frac{R_0}{2} + \frac{R_0 \times R}{2}}{\frac{R_0}{2} + R}$



$= \dfrac{R_0(R_0 + 4R)}{2(R_0 + 2R)}$

$I_{total} = \dfrac{V}{R_{total}}$

Current through R.

$= I_2 = I_{total} \times \dfrac{\frac{R_0 \times R}{2}}{\frac{R_0}{2} + R}$

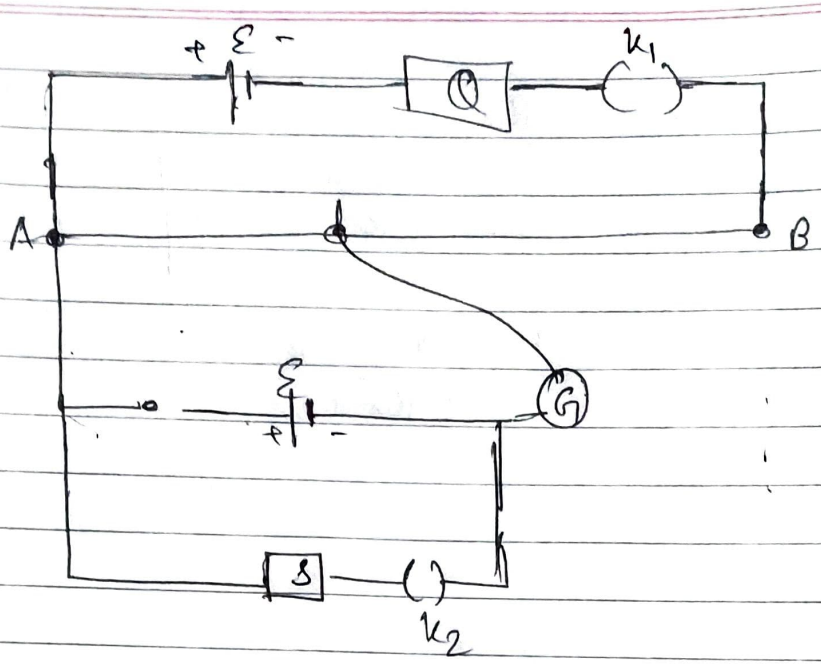
$= I_{total} \times \dfrac{R_0}{R_0 + 2R}$

$= \dfrac{V \cdot 2(R_0 + 2R)}{R_0(R_0 + 4R)} \times \dfrac{R_0 \times R}{R_0 + 2R}$

$= \dfrac{2VR_0R}{R_0(R_0 + 4R}$

Voltage across $R = I_2 R = \left(\dfrac{2VR}{R_0 + 4R}\right)$

2)



i) By increasing resistance R the current through AB decreases, so potential gradient decreases. Hence a greater length of wire would be needed for balancing the same potential difference. So the null point would shift towards B.

ii) By decreasing resistance S, the current through AB remains the same potential gradient doesn't change. As K_2 is open so there is no effect of S on null point.

3a) Principle of potentiometer :-

→ The potential drop across the length of a steady current carrying wire of uniform cross & action is proportional to the length of the wire.

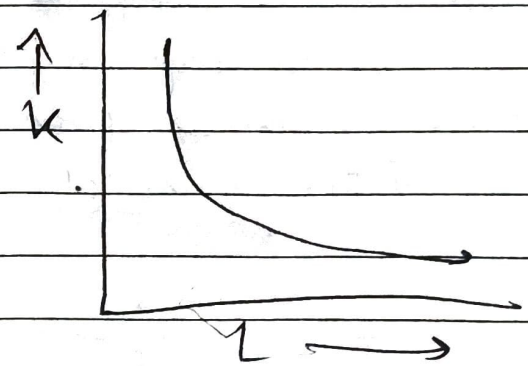
i) We use a long wire to have a lower value of potential gradient i.e a lower 'least' or greater sensitivity of the potentiometer.

ii) The area of cross-section has to be uniform to get a 'uniform wire' as per the principle of the potentiometer.

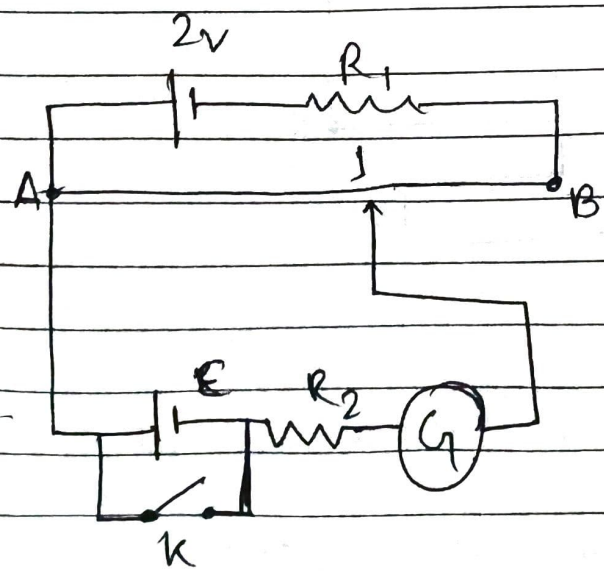
iii) The emf of the driving car has to be greater than the emf of the primary cells as otherwise no balance point would be obtained.

b) Potential gradient $K = \frac{V}{L}$.

∴ the required graph as shown.



4)



a) The purpose of high resistance R_2 is to reduce the current through the galvanometer when jockey is far from balance point, hence saves the galvanometer & the cell (of emf e) from being damaged.

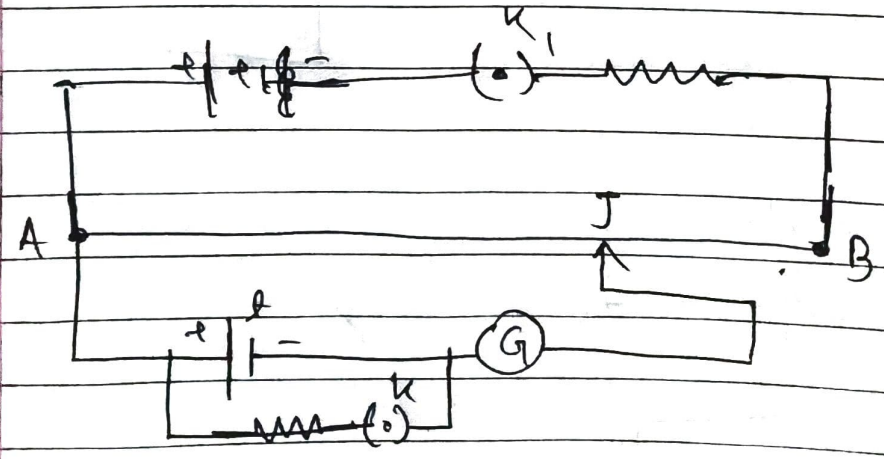
b) When resistance R_1 is decreased, the potential gradient of potentiometer wire increases, so balance point (J) shift to longer length of wire.

c) i) The balance point is not obtained because max emf across potentiometer wire is 2v

~~ii) The balance point is not obtained~~

ii) When key (K) is closed, the terminal potential difference of cell is zero; So balance point cannot be between A & J (since $V = kl \Rightarrow l = 0$ for $V = 0$)

5)



i) R_1 is increased because the potential gradient will increase.

ii) R_2 increased due to terminal P.d cell increased.